



02-16-01 528 Rec'd PCT/PTO 14 FEB 2001 PCT

PCT Applicant's Guide - Volume II - National Chapter - US

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Annex US.II, page 1

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(REV 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

15675P349

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/762990

INTERNATIONAL APPLICATION NO.
PCT FR00/01626

INTERNATIONAL FILING DATE
June 13, 2000

PRIORITY DATE CLAIMED
6/14/1999

TITLE OF INVENTION

EQUIPMENT FOR PURIFYING AIR, IN PARTICULAR CABIN AIR IN AIRCRAFT - UTILITY

APPLICANT(S) FOR DO/EO/US

Jean-Loup Bernard; Pascal Contini; Thierry Mantel

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b)) and PCT articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A subsequent specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

copy of the Form PCT/IB 301 & 304; formal drawing; request of filing; request for priority

U.S. APPLICATION NO. (if known, see 37 CFR 1.51) 09/762990	INTERNATIONAL APPLICATION NO. PCT FR00/01626	ATTORNEY'S DOCKET NUMBER 015675.P349
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17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482 nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by EPO or JPO \$1000.00 International preliminary examination fee (37CFR1.482)not paid to USPTO but International Search Report prepared by the EPO or JPO.... \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$700.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: left;">CALCULATIONS FOR PTO USE ONLY</th> </tr> <tr> <td style="width: 60%;"></td> <td style="width: 40%;"></td> </tr> <tr> <td>ENTER APPROPRIATE BASIC FEE AMOUNT =</td> <td style="text-align: right;">\$ 860.00</td> </tr> <tr> <td>Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).</td> <td style="text-align: right;">\$</td> </tr> <tr> <td> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">CLAIMS</th> <th style="width: 20%;">NUMBER FILED</th> <th style="width: 20%;">NUMBER EXTRA</th> <th style="width: 20%;">RATE</th> <th style="width: 20%;"></th> </tr> <tr> <td>Total claims</td> <td>20 - 20 =</td> <td>0</td> <td>X \$18.00</td> <td style="text-align: right;">\$ 0.00</td> </tr> <tr> <td>Independent claims</td> <td>1 - 3 =</td> <td>0</td> <td>X \$78.00</td> <td style="text-align: right;">\$ 0.00</td> </tr> <tr> <td colspan="4">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td style="text-align: right;">\$ 260.00</td> </tr> <tr> <td colspan="4">TOTAL OF ABOVE CALCULATIONS =</td> <td style="text-align: right;">\$ 1120.00</td> </tr> </table> </td> <td style="text-align: right;">\$</td> </tr> <tr> <td>Reduction of 1/2 for filing by small entity, if applicable. 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a. ☒ A check in the amount of \$ 1120.00 to cover the above fees is enclosed.

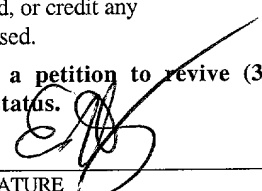
b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
overpayment to Deposit Account No. 022666. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR
1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

Blakely, Sokoloff, Taylor & Zafman LLP
12400 Wilshire Blvd. 7th Floor
Los Angeles, CA 90025-1026

SIGNATURE 
 Eric S. Hyman
 NAME
 30,139
 REGISTRATION NUMBER

EQUIPMENT FOR PURIFYING AIR, IN PARTICULAR CABIN AIR IN
AIRCRAFT

The present invention relates in general to
apparatus for treating air, in particular the air in
5 aircraft cabins.

The quality of air in an aircraft cabin is a problem
that involves numerous parameters. Thus, the air must
comply with maximum acceptable concentrations both for
microparticles and for microorganisms, so as to ensure
10 that the air is well tolerated by human beings.

Furthermore, mainly for reasons of comfort, it is
desirable for its relative humidity and its odoriferous
molecular content to be situated at "comfort" values.

Conventional equipment for treating cabin air
15 comprises apparatus for mixing air that has been recycled
from the cabin with new air taken from outside the
aircraft, the air being filtered with a conventional
particle filter.

That conventional approach gives rise to several
20 problems:

· firstly, a particle filter is very poorly suited
to purifying air containing various forms of
microorganism; thus, the air recycled from the cabin is
purified essentially only from the particle point of view
25 and it is reinjected into the cabin without the
microorganisms contained therein being eliminated to any
significant extent; furthermore, those microorganisms
which are indeed stopped by the filter proliferate
thereon, taking nourishment from the various particles
30 that the filter stops; it is also known that such a
particle filter is unsuitable for stopping virus type
microorganisms; finally, it should be observed that
odoriferous molecules (cooking odors, kerosene odors,
human odors, etc.) are not stopped by such a filter;

35 · secondly, it is necessary to replace the filter in
extremely regular manner;

· thirdly, new air needs to be taken from outside the aircraft (and in practice air which is already relatively hot and taken from the aircraft engines) leading directly to a loss of engine power; as an
5 example, renewing cabin air to the extent of 25% typically gives rise to a loss of engine power of about 1%; it will be understood that this goes specifically against recent trends of achieving the maximum possible savings in terms of aircraft consumption; and

10 · finally, the fact that a large proportion of cabin air is renewed presents the drawback of delivering air into the cabin that is extremely dry; typically, air taken from the outside has relative humidity in the vicinity of 5%, whereas the comfort threshold is situated
15 at about 40%.

To resolve this last problem, it is known to associate the cabin air treatment equipment with a humidifier, however the other problems are not resolved; on the contrary, adding water to the air for treatment
20 can encourage the development of certain microorganisms.

Another known solution consists in causing the air taken from the cabin for recycling purposes to pass over silica gel; the air that has been dried in this way is delivered to the lining zones of the aircraft to reduce
25 condensation phenomena therein, and the recovered water is used for humidifying new air. This likewise gives rise to problems of bacteria proliferating, given that silica gel constitutes a good medium for such proliferation.

30 Finally, it is known that air treatment apparatus including a particle filter can be associated with an activated carbon filter which stops microorganisms and odoriferous molecules better; however that gives rise to new problems: firstly, the head losses in the air
35 treatment circuit are significantly increased, thus making it necessary to use more powerful air-circulation fans with an undesirable increase in energy consumption

on board the aircraft; secondly the effectiveness of such an activated carbon filter is very limited in time, so it needs to be changed on practically every stopover; and finally such carbon filters are known to constitute
5 excellent media for bacterial proliferation; for these reasons, such carbon filters are practically never used.

The present invention seeks to mitigate those limitations in the state of the art and to propose cabin air treatment equipment:

- 10 · which is effective, in particular presenting remanent action;
- whose energy consumption remains moderate; and finally
- which makes it possible to obtain relative
15 humidity in so-called "comfort" ranges, without it being necessary to provide a special humidifier.

Thus, the present invention provides equipment for purifying air, in particular aircraft cabin air, the equipment being characterized in that it comprises means
20 for injecting a spray of water laden with nascent oxygen into the air to be purified.

Other preferred but non-limiting features of the equipment of the present invention are as follows:

- 25 · the equipment further comprises a particle filter interposed on the path of the air to be treated;
- the particle filter includes adsorption means;
- the means for injecting a spray of water laden with nascent oxygen comprise a source of mineralized water and an activator in which the mineralized water is
30 put into contact with a metallic catalyst of suitable purity;
- the metallic catalyst is a precious metal such as silver;
- the metallic catalyst is provided on a medium
35 having large specific surface area;

· the source of mineralized water comprises a supply of water that is mineralized little or not at all, and a mineralization reactor;

· for use in an aircraft having at least one engine
5 with an associated compressor, the water supply is fed from condensates coming from said compressor;

· the means for injecting a spray of water laden with nascent oxygen further comprise a mixing chamber receiving both the air to be treated and the water laden
10 in nascent oxygen from the activator;

· the particle filter can be located downstream or upstream from the mixing chamber; and

· the equipment further comprises means for mixing the purified air with new air.

15 Other features, objects and advantages of the present invention will appear more clearly on reading the following detailed description of a preferred embodiment thereof, given by way of non-limiting example and made with reference to the accompanying drawing, in which the
20 sole figure is a block diagram of cabin air treatment equipment of the present invention.

This installation comprises a supply of water 10 which advantageously contains water taken from the condensates of the compressors associated with the
25 engines of the aircraft. In general, this condensation water is poor in minerals.

The water contained in this supply is conveyed by a pipe C1 to a mineralization reactor 20 for increasing the mineral content of the incoming water. By way of
30 example, this reactor can be constituted by a cartridge possessing an inlet for water to be mineralized and an outlet for mineralized water, and containing an inorganic compound in oxygenized form, e.g. calcium carbonate.

The equipment further comprises an activator 30
35 having an inlet connected to the outlet of the reactor 20 by a pipe C2. This activator is preferably constituted by a catalytic cartridge such as a folded cartridge based

on activated carbon cloth, on which a layer of catalyst has been deposited. The catalyst is preferably constituted by metallic silver of suitable purity, or by some other precious metal.

5 In this activator, the inorganic salt contained in the water reacts with the catalyst to form nascent oxygen, in particular molecules of O_3 , of O_2^- , OH^- , etc.

10 For further details about how to implement such an activator, reference can be made to the article "Carbon, Vol. 36, Nos. 1-2, pp. 61-65, 1998".

15 The outlet from the activator 30 is connected by a pipe C3 to a first inlet of a mixing chamber 40. Another inlet to said chamber 40 receives, via a pipe C4, air for treatment that had been taken from the aircraft cabin.

 This mixing chamber operates, for example, on the principle of a Venturi mixer, and serves to spray into the air to be treated water containing nascent oxygen of the kind generated at the outlet from the activator 30.

20 This nascent oxygen is strongly oxidizing and is therefore distributed in generally uniform manner throughout the air that is delivered to the cabin, and as a result organic compounds (odors, microorganisms, ...) present in the recycled air are progressively oxidized over time, thereby causing them to be destroyed.

25 The outlet from the mixing chamber is connected by a pipe C5 to the inlet of a particle filter 50 of conventional type. Optionally, the filter can also perform an adsorption function, e.g. by incorporating activated carbon cloth.

 At the outlet from the filter 50, the air is delivered to the cabin via a pipe C6.

35 It will be understood that by means of such equipment, a spray of water containing nascent oxygen is introduced into the air for recycling, and the action of the nascent oxygen can take place progressively, and thus with excellent efficiency.

In particular, initial oxidation reactions on compounds to be destroyed will take place as soon as the mixture is formed, and thereafter also in the pipes C5 and C6, and finally they continue in the cabin. This
5 thus constitutes remanent action that is particularly effective.

In addition, the nascent oxygen present in the mixture reaching the filter 50 also has the power of destroying compounds that have previously accumulated in
10 the filter, and thus of avoiding any proliferation of microorganisms on the surface of the filter.

It should be observed at this point that any viruses, bacteria, and microbes contained in the air to be treated in the filter 50 are destroyed without
15 releasing endotoxins, and this is particularly advantageously.

It would also be observed that because water is introduced into the air to be treated, it is easy to maintain the humidity of this air at a comfortable level.

20 Naturally, the equipment further comprises appropriate devices both for circulating the air to be treated (a suction fan or a blower) and for circulating water upstream or downstream from the reactor 20 or the activator 30 (a pump).

25 In addition, the person skilled in the art knows how to apply numerous variants or modifications to the present invention.

In particular, the present invention can be implemented together with apparatus for delivering a
30 fraction of new air. Under such circumstances, the new air is mixed with the recycled air at a point that is preferably downstream from the filter 50.

Furthermore, the catalyst provided in the activator 30 can be provided on any medium that has sufficient
35 specific surface area, such as silica, alumina, a clay, or a zeolite.

[illegible]

CLAIMS

- 1/ Equipment for purifying air, in particular aircraft cabin air, the equipment being characterized in that it comprises means (10, 20, 30, 40) for injecting a spray of water laden with nascent oxygen into the air to be purified.
- 2/ Equipment according to claim 1, characterized in that it further comprises a particle filter (50) interposed on the path of the air to be treated.
- 3/ Equipment according to claim 2, characterized in that the particle filter (50) includes adsorption means.
- 4/ Equipment according to any one of claims 1 to 3, characterized in that the means for injecting a spray of water laden with nascent oxygen comprise a source of mineralized water (10, 20) and an activator (30) in which the mineralized water is put into contact with a metallic catalyst of suitable purity.
- 5/ Equipment according to claim 4, characterized in that the metallic catalyst is a precious metal such as silver.
- 6/ Equipment according to claim 5, characterized in that the metallic catalyst is provided on a medium having large specific surface area.
- 7/ Equipment according to any one of claims 4 to 6, characterized in that the source of mineralized water comprises a supply (10) of water that is mineralized little or not at all, and a mineralization reactor (20).
- 8/ Equipment according to claim 7, used in an aircraft having at least one engine with an associated compressor, characterized in that the water supply (10) is fed from condensates coming from said compressor.

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09/762990

Attorney Docket No.: 15675P349

JC02 Rec'd PCT/PTO 1 4 FEB 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

JEAN-LOUP BERNARD, ET AL.

Application No.:

Filed:

For: **EQUIPMENT FOR PURIFYING AIR, IN
PARTICULAR CABIN AIR IN
AIRCRAFT - UTILITY**

Art Group:

Examiner:

Assistant Commissioner for Patents
Washington, D.C. 20231

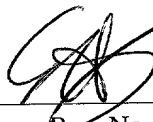
TRANSMITTAL OF FORMAL DRAWINGS

Sir:

Enclosed herewith for filing in the above-identified U.S. Patent Application are the formal drawings, 1 sheet including 1 Figure. Applicant hereby authorizes any additional extension or petition fees under 37 C.F.R. §1.17 or credit for any overpayment to our Deposit Account No. 02-2666. A copy of the Fee Transmittal sheet is enclosed.

Respectfully submitted,

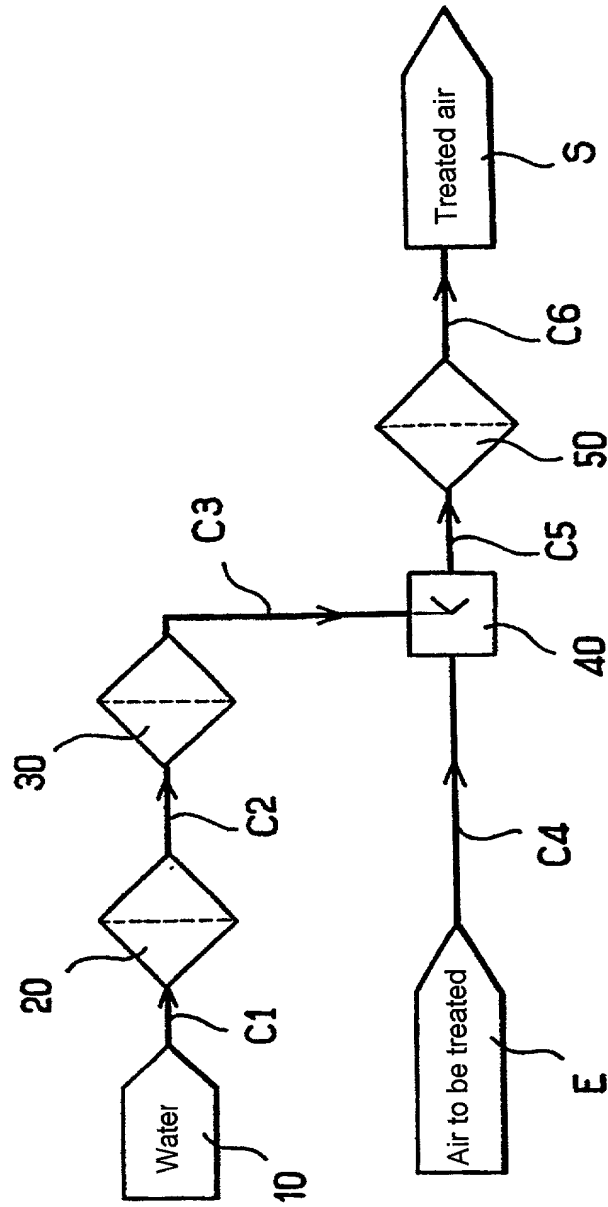
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN



Dated: February 14, 2001

Eric S. Hyman, Reg. No. 30,139

12400 Wilshire Blvd., 7th Floor
Los Angeles, California 90025
Telephone: (310) 207-3800



[illegible]

For: EQUIPMENT FOR PURIFYING AIR, IN PARTICULAR CABIN AIR IN AIRCRAFT

DECLARATION

I, Andrew Scott Marland, of 35, avenue Chevreul, 92270 BOIS COLOMBES, France, declare that I am well acquainted with the English and French languages and that the attached translation of the French language PCT international application, Serial No. **PCT/FR00/01626** is a true and faithful translation of that document.

All statements made herein are to my own knowledge true, and all statements made on information and belief are believed to be true; and further, these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any document or any registration resulting therefrom.

ASmar

Date: January 30, 2001

Andrew Scott Marland

PCT/FR00/01626
(Application Serial No.)

13.06.2000
(Filing Date)

Pending
(Status - patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status - patented, pending, abandoned)

(Application Serial No.)

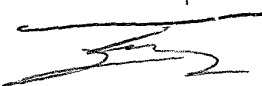
(Filing Date)

(Status - patented, pending, abandoned)

I hereby appoint BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, a firm including :
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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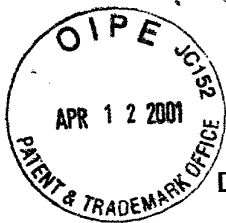
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DECL US BLA



Our ref.: 15675-P349

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

EQUIPMENT FOR PYRIFYING AIR, IN PARTICULAR CABIN AIR IN AIRCRAFT

the specification of which

is attached hereto
was filed on June 13, 2000
Application Serial No. PCT FR00/01626^{as}
And was amended on
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I do not know and do not believe that the same was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 199, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

99 07488
(Number)

FRANCE
(Country)

14.06.1999
(Day/Month/Year Filed)

XX
Yes No

(Number)

(Country)

(Day/Month/Year Filed)

Yes No

(Number)

(Country)

(Day/Month/Year Filed)

Yes No

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.